BNL-104752-2014-TECH

AGS/AD/Tech Note No. 336;BNL-104752-2014-IR

RLRM SYSTEM DIAGNOSTICS

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April 1990

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U.S. Department of Energy

USDOE Office of Science (SC)

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Technical Note

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April 11, 1990

A bank of 16 resistors, each 1 GΩ, 5% tolerance, is mounted at the RLRM racks in the RF Building. Figure 1 is a schematic of one channel of the RLRM system showing a 1 GΩ resistor in place of the detector. Connecting these resistors in place of the detectors produces a simulated signal of 200 nA (200 V/1 GΩ). With the resistors in, the analog signals available via XBAR show a d.c. offset of 200 mV (feedback resistor = 1 MΩ). The digital signals for these channels via the Fortran program RLRM have a mean value of about 1400 counts per second, with a standard deviation of 60.

The resistor bank is routinely used to check every RLRM channel before start up of operations, and when diagnostics are warranted. During normal operation, 7 of the resistors are connected to the first 7 spare channels. A resistor switched by a relay is normally connected to spare channel 8. Figure 2 is a printout from the RLRM program showing digital data for the spare channel.

System timing is checked via a relay driven by a 556 dual timer circuit, to switch a 1 GΩ resistor at the input to a selected channel. The timer is triggered at T_o, starting a delay of 500 msec, before the relay is energized for 500 msec. This simulates a signal pulse of 200 mV starting 500 msec after T_o, ending 1000 msec after T_o. Net timer accuracy is approximately ± 10 msec. Figure 3 is a schematic of the relay timer circuit. Figure 4 is an oscilloscope trace photograph showing the pulsed signal from spare channel 8.

A Cesium-137 source at 160 mCi has been procured to aid in RLRM detector testing and calibration. As a test, the source was positioned in contact with 9 RLRM detectors in the E superperiod, using a 200 V bias supply and a picoammeter to measure the current produced. Each measurement consisted of a reading of the ionization current with the source extended, less the reading with the source in the shielded position in the source holder. The mean and standard deviation for the two measurements on each of the nine detectors was 43 ± 3 pA. (Note that this current when digitized by the V/F can produce only 0.3 counts/second.) It is planned that all the detectors will be calibrated at the end of the summer shutdown, when residual activity is minimum.

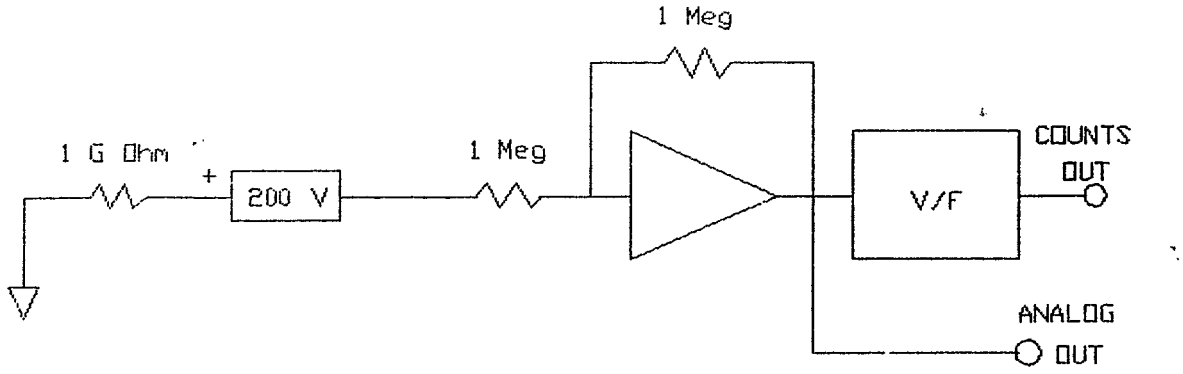

FIGURE 1. Schematic of RLRM channel with ionization detector replaced by 1 GOhm resistor.

U-P SET UP: MODE=1 500 TO 1500MS PLOT NUMBER 1 DISPLAYED
13-MAR-90 TIME=10:06 04.0

A	B	C	D	E	F	G	H	I	J	K	L	S
1	0	1	1	1	418	63	1	1	1	1	0	1267
1	1	1	1	1	0	10	1	16	1	1	1	1339
1	1	1	1	1	894	1	1	779	1	1	1	1392
1	1	1	1	1	64	1	1	1	1	1	1	1411
1	1	1	1	1	73	1	1	1	1	1	1	1451
1	1	0	1	1	445	1	2	1	1	1	1	1424
1	1	1	1	1	103	2	1	1	1	1	1	1408
1	0	0	0	1	183	10	56	5	1	2	1	753
1	1	1	1	20	67	1	1	0	1	1	1	
1	1	1	1	113	114	1	1	11	1	1	1	

TOTAL = 3540 CBM AT 500MS =1770 CBM AT1500MS = 982
TOTAL COUNTS

2	0	2	2	2	1743	185	4	0*	2	2	0	4014
2	2	2	2	2	0	41	2	63	2	2	2	4242
2	2	2	2	22	2576	2	2	2455	2	2	2	4409
2	2	2	2	2	207	2	2	2	2	2	2	4466
2	2	2	2	2	236	2	2	2	2	2	2	4594
2	2	0	2	2	1416	2	21	2	2	2	2	4510
2	2	0*	2	2	328	9	2	2	2	2	2	4461
14	0	0	0	6	541	20	161	9	2	11	5	755
16	2	2	2	39	226	2	2	0	2	5	2	
2	2	2	2	473	304	2	0*	41	2	2	2	

TOTAL = 11337

Figure 2. Digital printout from RLRM showing data for spare channels 1 to 7 with 1 GΩ resistors replacing detectors; mean is 1385, standard deviation is 62. Spare channel 8 is switched 1 GΩ resistor, in at 500 msec, out at 1000 msec.

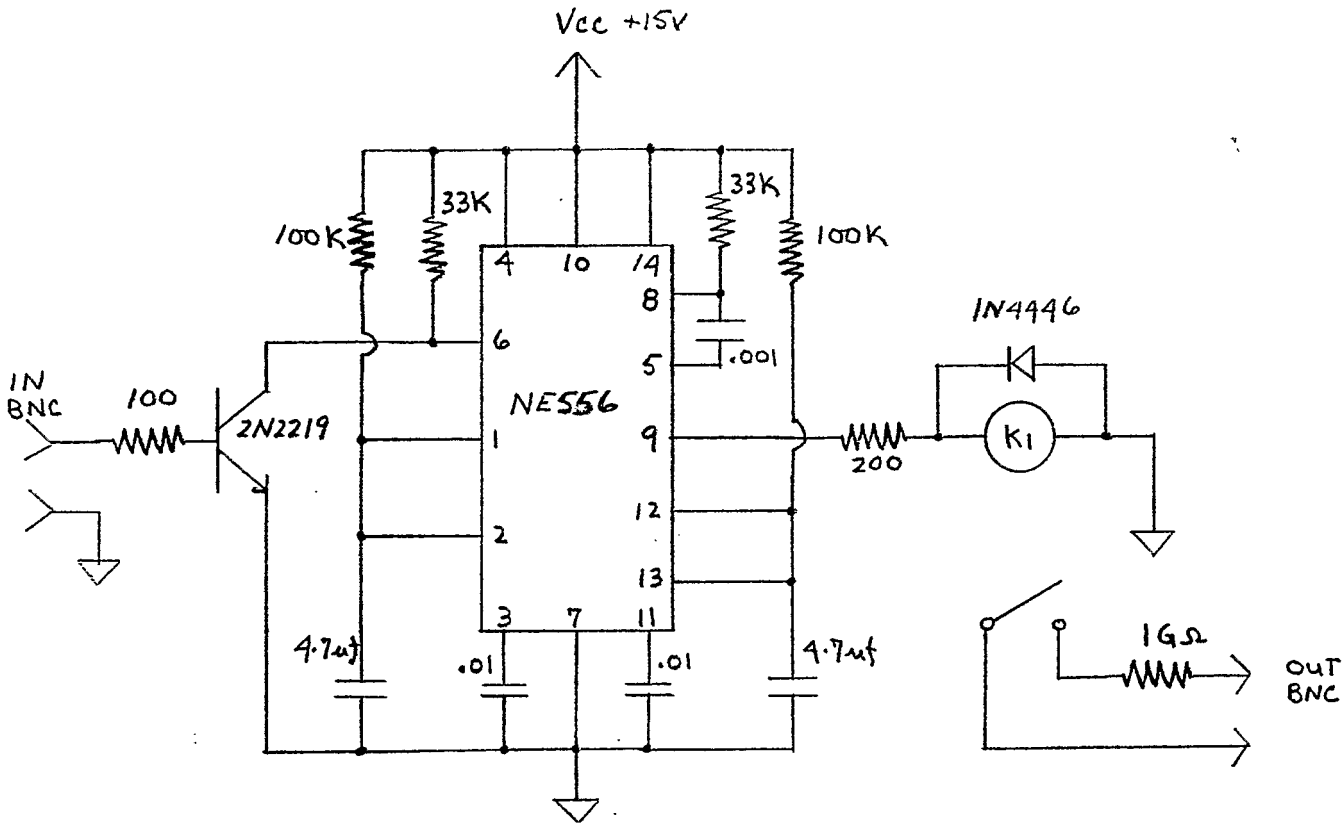

Figure 3. Schematic of relay timer circuit.

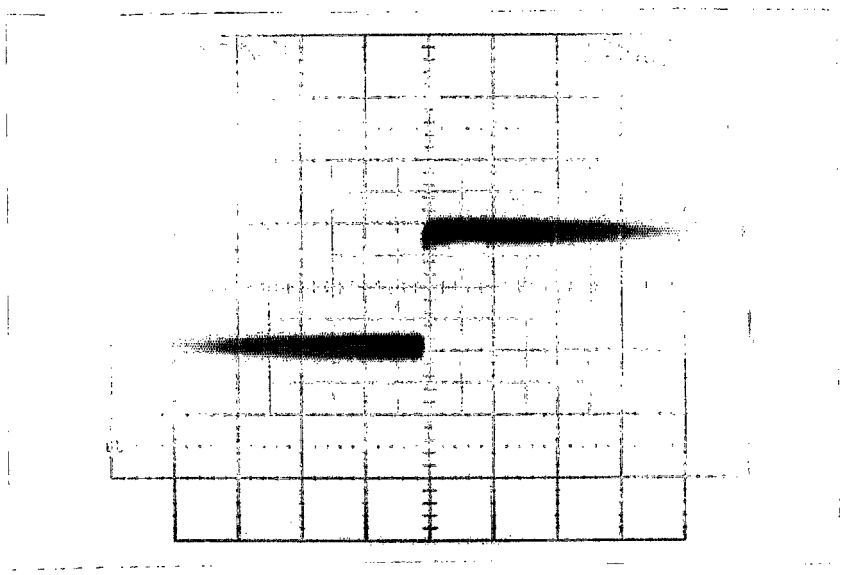

Figure 4. Scope trace of RLRM spare channel 8.